



## Scaling Smart Appliances for Spatial Data Synthesis

Luis Pineda-Morales, Balaji Subramaniam, Kate Keahey, Gabriel Antoniu, Alexandru Costan, Shaowen Wang, Anand Padmanabhan, Aiman Soliman

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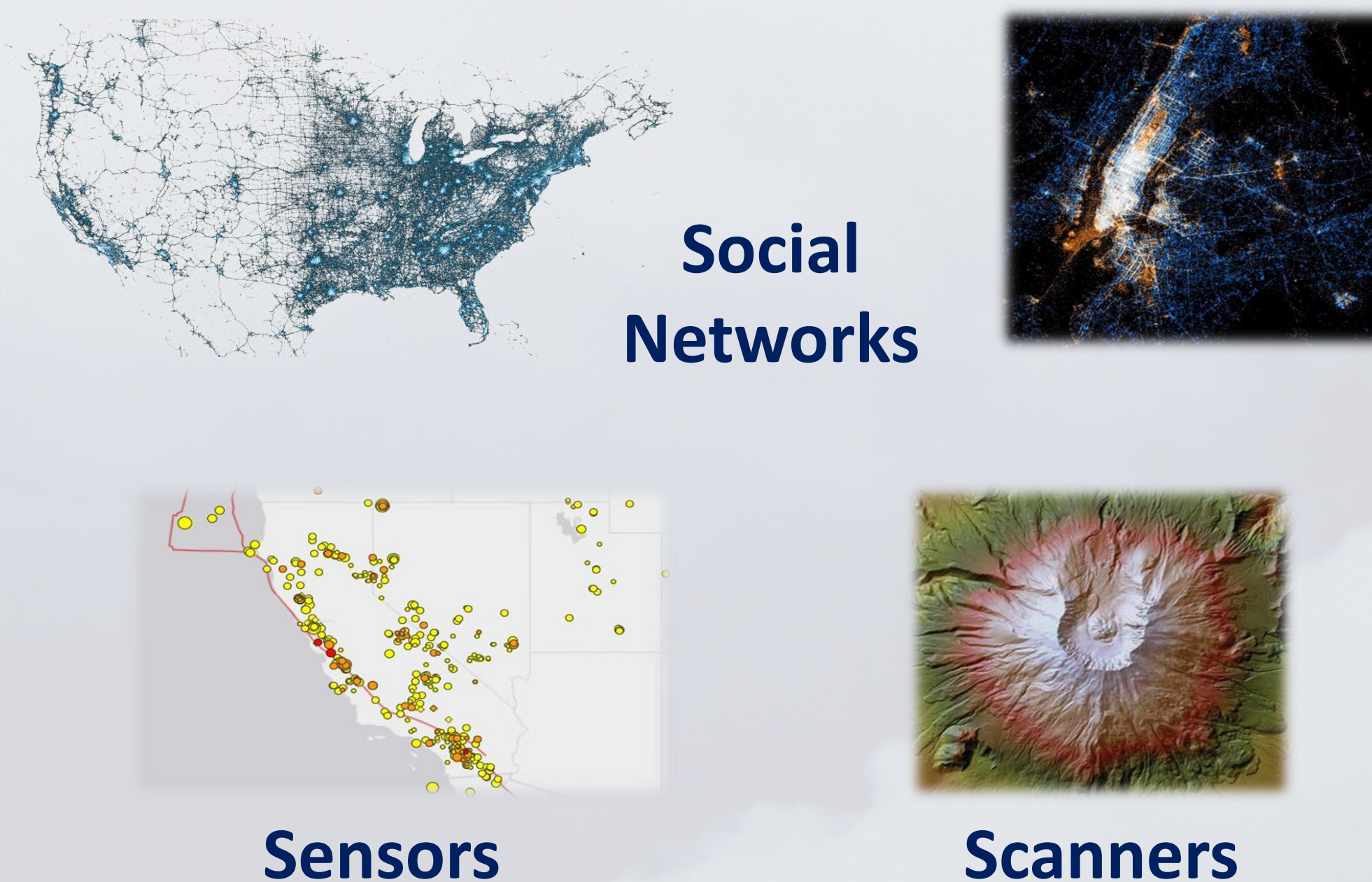
# Scaling Smart Appliances for Spatial Data Synthesis

Luis Pineda-Morales<sup>1,2</sup>, Balaji Subramaniam<sup>3</sup>, Kate Keahey<sup>3</sup>, Gabriel Antoniu<sup>2</sup>, Alexandru Costan<sup>2,4</sup>  
Shaowen Wang<sup>5,6,7</sup>, Anand Padmanabhan<sup>5,6,7</sup>, and Aiman Soliman<sup>5,6</sup>

## Problem

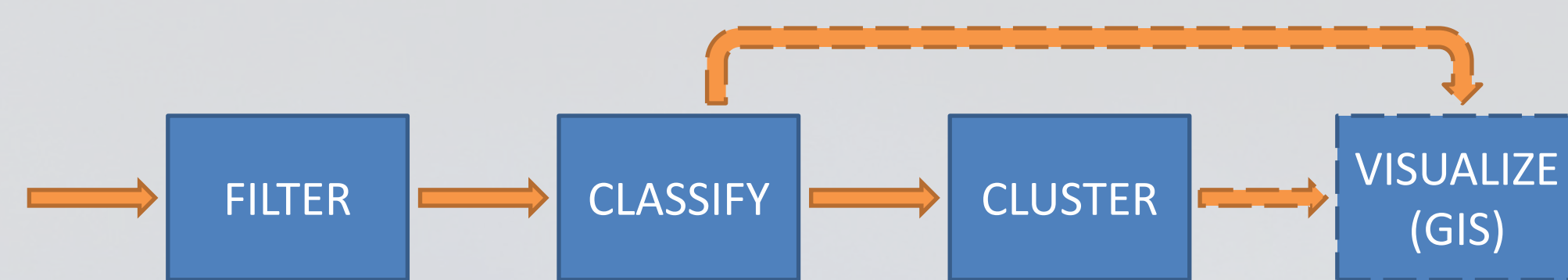
- *Spatial data streams* have grown considerably in size and complexity
- Volatility and growing number of user requests through CyberGIS Gateway [1]

## Dynamic Data Streams



## CyberGIS

- Software integration for sustained geospatial innovation
- Achieve *scalability* for large geospatial problems and number of users
- *Use Case*: Spatial index for estimating home and work relocation, and unemployment rates using geo-located twitter data

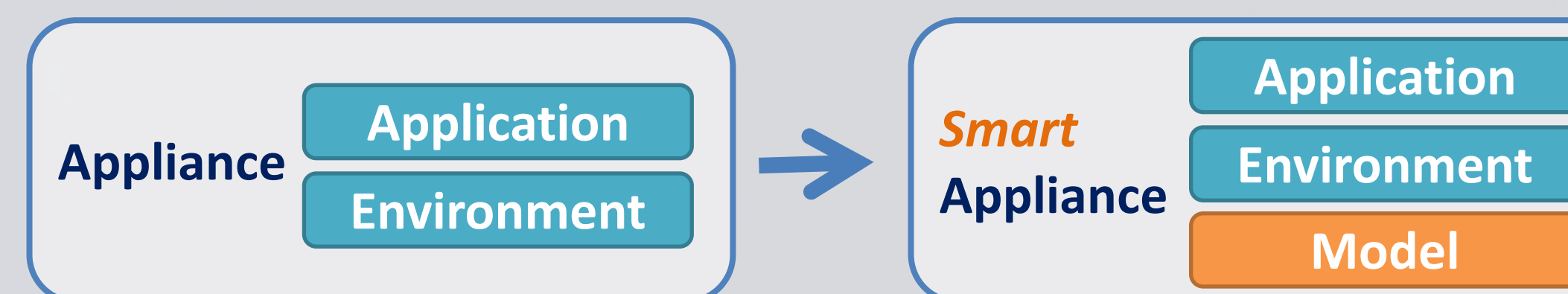


## Challenges

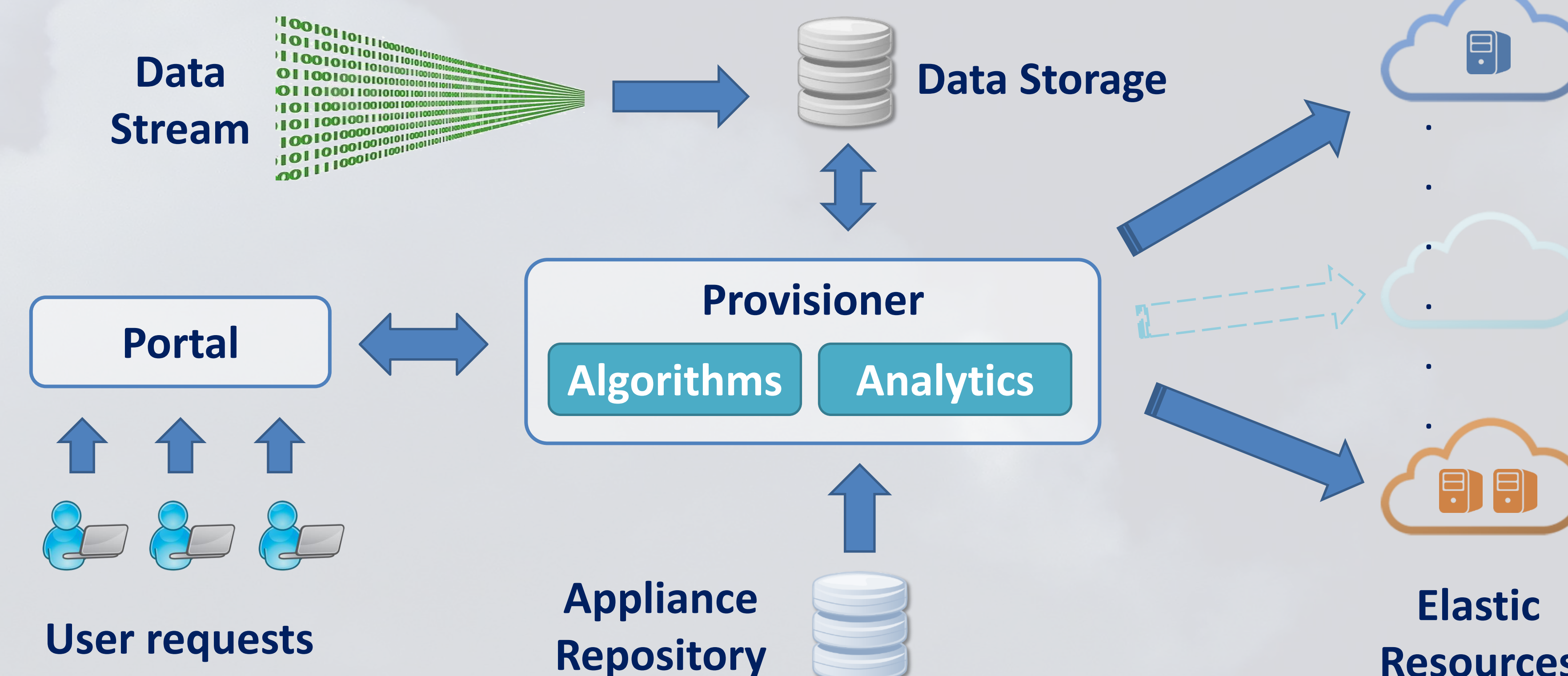
- How to deal with data and user requests volatility?
- How can we provision appliances quickly and efficiently?

## Approach

- Scale the computer resources in order to meet volatility
- *Smart Appliances*



## Architecture



## Experimental Setup

- 2 bare-metal Chameleon nodes: 24 cores (48 VCPUs), 256 GB disk, 128 GB RAM
- Hadoop 2.7 (YARN): 128 MB default HDFS block size, up to 192 containers
- Up to 20 days of geo-located tweets (~1.9GB/day)

## References

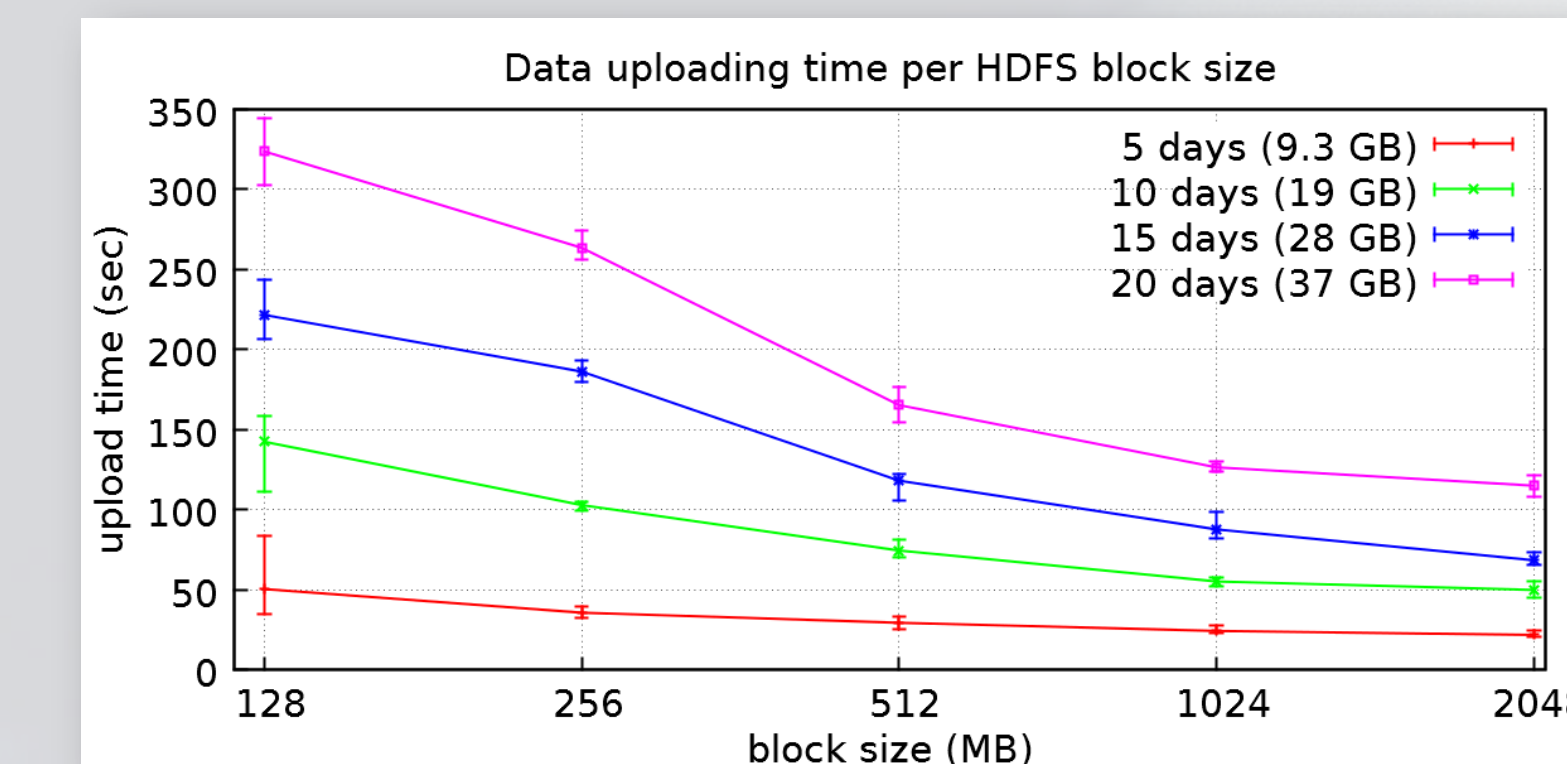
- [1] CyberGIS Software Integration for Sustained Geospatial Innovation <http://cybergis.cigi.uiuc.edu/>
- [2] Infrastructure Outsourcing in Multi-Cloud Environment, Keahey, K., et al. Workshop on Cloud Services, Federation, and the 8th Open Cirrus Summit. 2012

## Acknowledgements

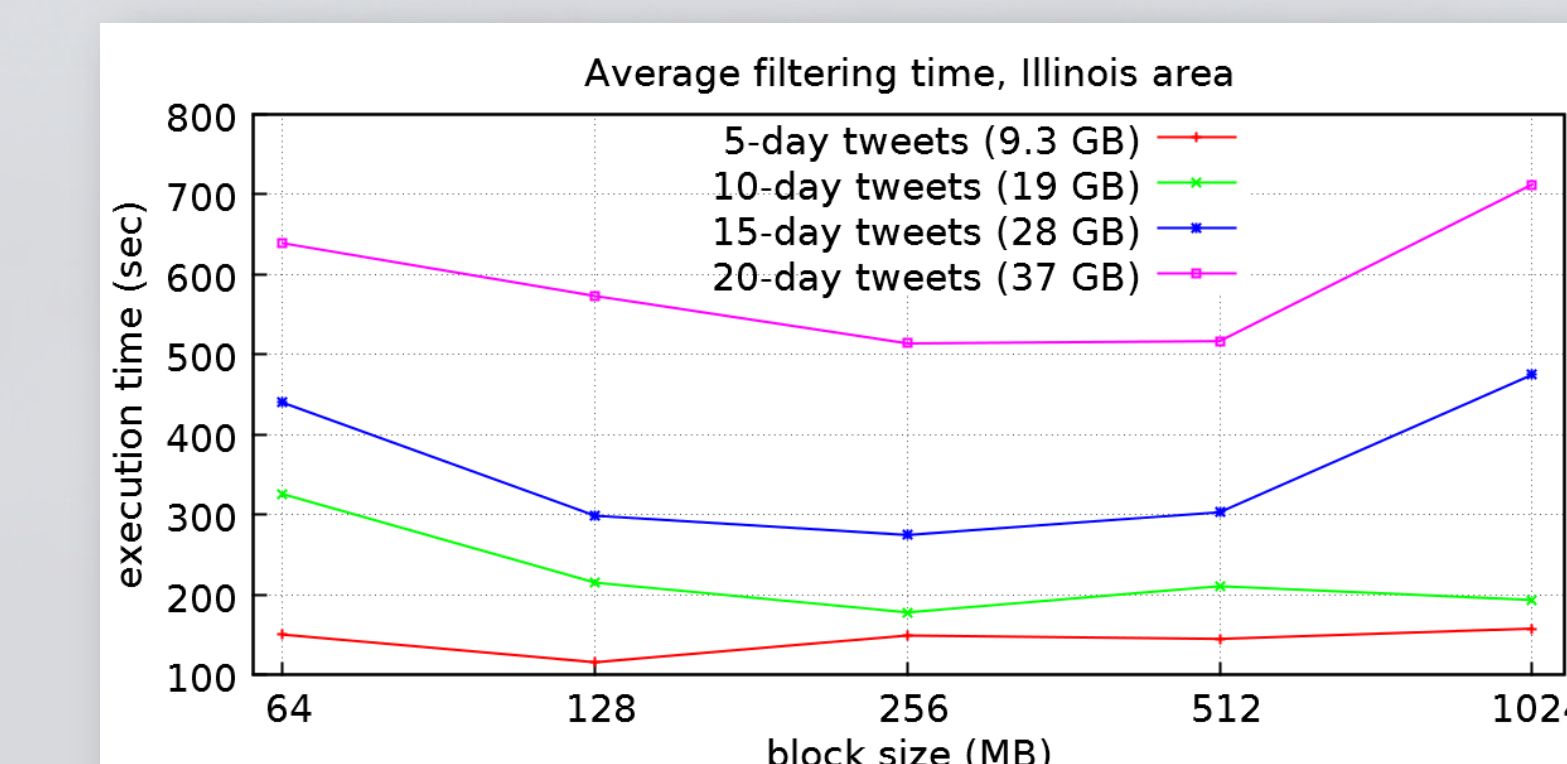
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- This material is based in part upon work supported by the U.S. National Science Foundation under grant numbers: 1047916, 1429699, and 1443080. Insightful comments and feedbacks received from the following members of the CyberGIS Center: Junjun Yin and Kiumars Soltani are greatly appreciated

## Developing a Statistical Model

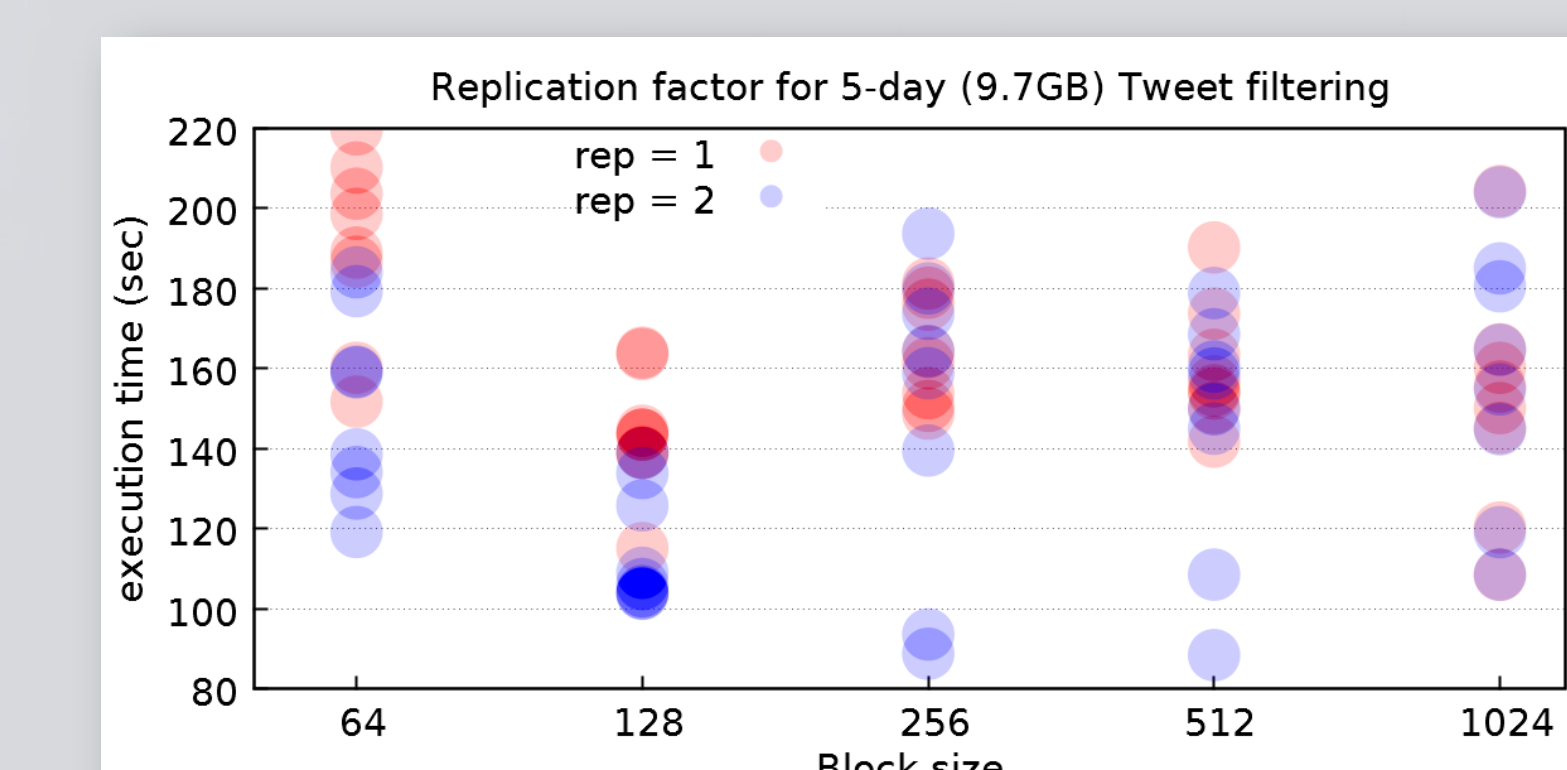
- **Data Upload**
- 70%+ improvement with larger block size, compared to the default 128 MB



- **Execution Time**
- "Sweet spot" more evident in larger datasets



- **Data Replication**
- Large dataset: disk saturation



## Future Work

- Scale out to months of geo-located tweets
- Test in other [virtualized] infrastructures
- Define models for elastic appliances
- Support for new job releases of the use case involving Phantom elastic provisioner [2]

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